Catalogue of American Amphibians and Reptiles.

Platz, J.E. 1991. *Rana berlandieri*

Rana berlandieri Baird
Rio Grande Leopard Frog

Rana berlandieri Baird, 1859:27-28 (Figures 7-10 on Plate 36 are designated as "*Rana berlandieri*, Baird." Type-locality: "Southern Texas generally." No type specimen was designated. Lectotype (= cotype of Cochran, 1961:72), U.S. Natl. Mus. 131513 (Pace, 1974), an adult male from Brownsville, Cameron Co., Texas, collected by Capt. S. Van Vliet (examined by author), date of collection unknown.
Rana halecina berlandieri: Cope, 1875:32 (part).
Rana halecina austricola: Cope, 1886:517 (part).
Rana virescens austricola: Cope, 1889:390 (part).
Rana virescens berlandieri: Cope, 1889:398 (part).
Rana virescens virescens: Cope, 1889:401 (part).
Rana virescens brachycephala: Cope, 1889:403 (part).
Rana pipiens berlandieri: Mittleman and Gier, 1942:13 (part).
Rana berlandieri brownorum: Sanders, 1973:87 (part).
Rana brownorum: Hillis et al., 1983:134 (part).

• **Content.** No subspecies are recognized.

• **Definition and Diagnosis.** This large (56-112 mm SVL) species of the *Rana pipiens* complex is distinguished from other leopard frogs by a combination of traits. The supralabial stripe in adult specimens is incomplete (absent or diffuse anterior to the eye). Dorsolateral folds are well developed but broken, with the posterior portion displaced medially in the region of the base of the urostyle. Males exhibit external vocal sacs and possess prominent vestigial oviducts. The venter is a cream color with mottling on the chin of older individuals. The ventral surface of the upper thighs and adjacent skin on the belly may show a pale yellow color. The dorsum

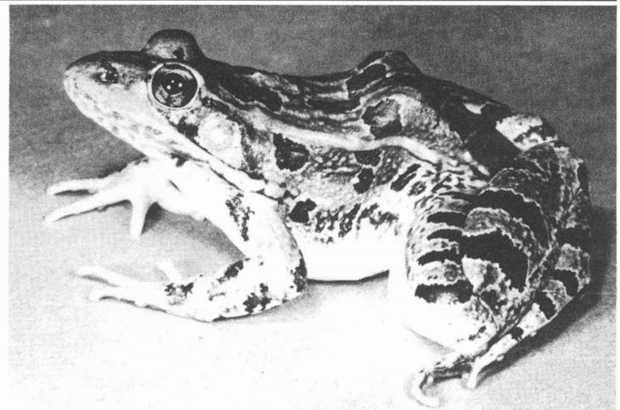
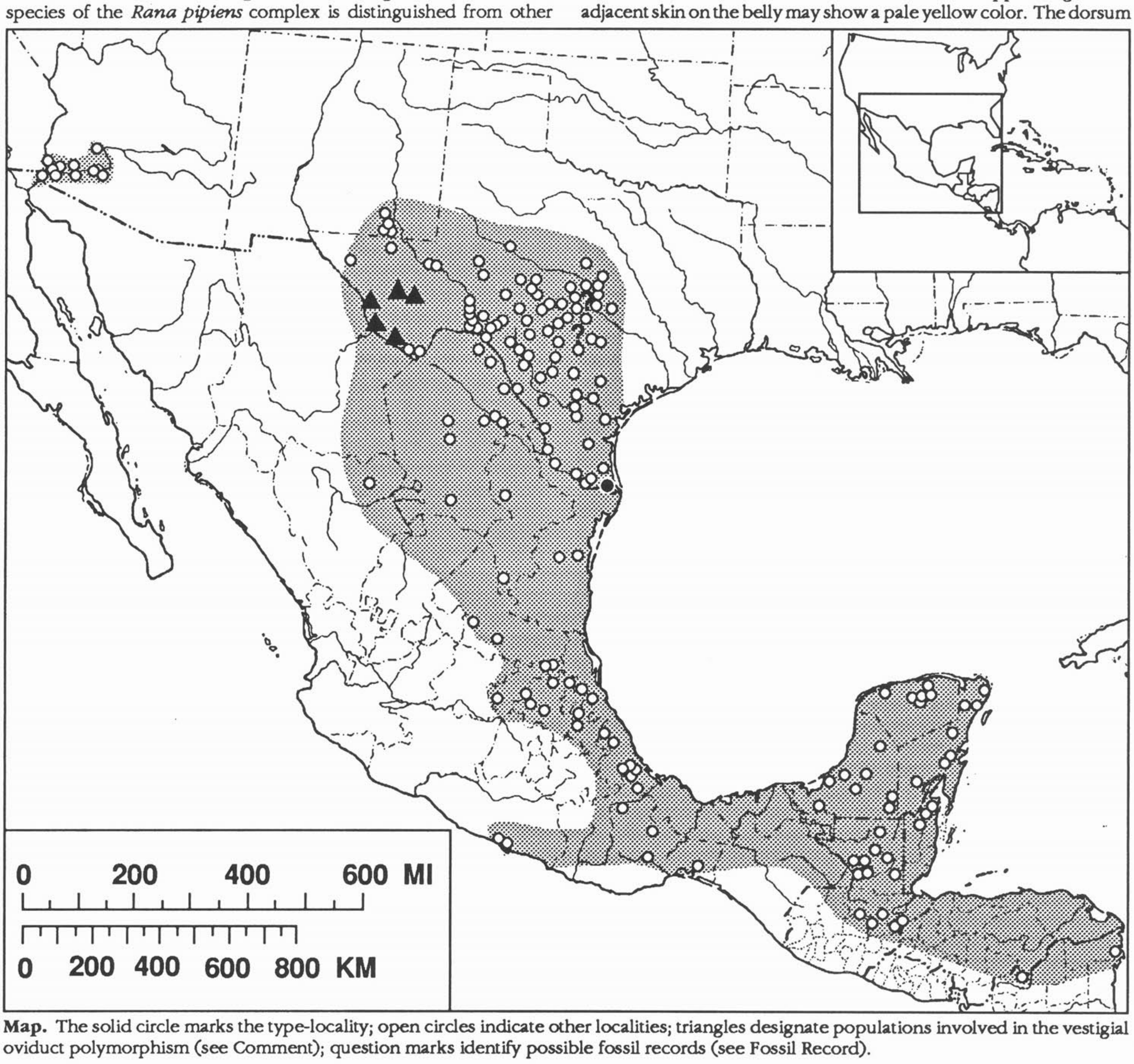


Figure 1. Adult female *Rana berlandieri* from San Angelo, Tom Green Co., Texas, photograph by author.



Map. The solid circle marks the type-locality; open circles indicate other localities; triangles designate populations involved in the vestigial oviduct polymorphism (see Comment); question marks identify possible fossil records (see Fossil Record).

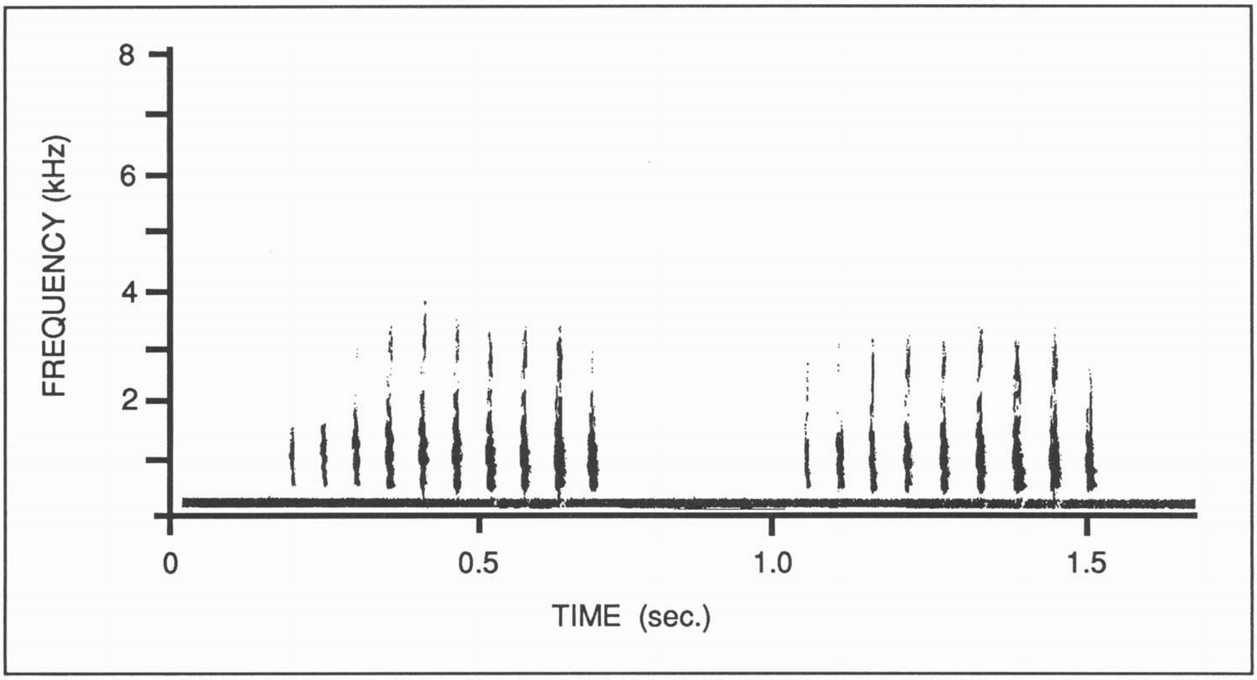


Figure 2. Audiospectrogram of the mating trill of *Rana berlandieri* from Sitting Bull Falls, Eddy Co., New Mexico. Recorded by J.S. Frost and D.M. Hillis, July 1981. Water temperature was 17 C.

contains numerous irregular dark spots on a background which may range in color from gray, gray green, or khaki green to bright green or brown.

The advertisement call is a series of trills (notes) averaging 0.5 sec. at 15° C. Each note contains a variable number of pulses (9-11 at 15° C) producing a pulse rate of approximately 20 per sec. The vocal repertoire is complex and includes additional sounds including "low amplitude" trills, "grunts" and "grind" notes in various combinations.

Live specimens of large tadpoles (to 95 mm) are olive with a yellow cast on the dorsum and sides. The iris is gold with minute flecks of black. The peritoneum is black dorsally, shading to gray ventrally. The tail coloration consists of dark and pale spots or a more sharply defined reticulate pattern of black and white.

• **Descriptions.** Cope (1889), Mittleman and Gier (1942), Wright and Wright (1949), Conant (1975), Stebbins (1985), and Conant and Collins (1991) provided descriptions of the adult. Scott and Jennings (1985) described the tadpole from New Mexico specimens.

• **Illustrations.** Cope (1889) illustrated an adult (the lectotype of Pace, 1974) as well as the ventral view of the front and hind foot. Wright and Wright (1949), provided black and white photos; photos 3-5 correspond to figures 9,10, and 7 of Cope's plate 36. Platz (1972) contains a black and white photo of an adult female. Conant (1975), Stebbins (1985), and Conant and Collins (1991) included colored illustrations of adults. Hillis (1982) provided line drawings of dorsal and lateral views of a tadpole. Scott and Jennings (1985) provided black and white photos and camera lucida drawings of the body, eye, lateral line system, and mouth parts of tadpoles. McAlister (1962) provided sonograms of the chuckle call, Gambs and Littlejohn (1979) of the mating trill and chuckle call, and Frost (1982) and Platz et al. (1990) of the mating trill.

• **Distribution.** The species occurs naturally in Eddy County, New Mexico and at scattered locales in adjacent parts of west Texas (see Comment), east and north to Collin Co., and south from here to Calhoun Co. Populations are common from central and southern Texas south among the eastern states of Mexico and as far as northeastern Nicaragua. It has been introduced at some point in the last 25 years to southwestern Arizona and is now established at numerous sites along the lower Colorado River from the Mexican border north to Yuma and east along the Gila River to approximately Buckeye, Maricopa Co., Arizona.

• **Fossil Record.** Dixon (1987) attributed partial skeletal remains from Bexar and Llano cos., Texas (reported by Holman, 1969) to *R. berlandieri*, but without reference to diagnostic features.

• **Pertinent Literature.** McAlister (1962) provided an assessment of mating call, mensural, and qualitative morphometric differences, as well as results of artificial crosses which compared *R. berlandieri* with *R. sphenocephala* over a 410 km east-west transect in Texas. Littlejohn and Oldham (1968) provided mating call comparisons. Purcell (1968) described artificial crosses between *R. berlandieri* and the "plains type" (= *R. blairi*) from the panhandle of Texas with high levels of abnormal development. Mecham (1969) made similar but more extensive comparisons involving crosses with specimens from both Texas and México and several U.S. and Mexican taxa. Salthe (1969) made an extensive comparison of electromorphs of lactate dehydrogenase and included *R. berlandieri* from Texas and New Mexico. Cuellar (1971) used artificial crosses to compare developmental compatibility of *R. berlandieri* with *R. areolata* and *R. sphenocephala*. Platz (1972) used morphometric and electrophoretic data from a north-south transect in Texas to quantify hybrid F1 adult and juvenile levels, providing evidence that the species was distinct from the "plains type" (= *R. blairi*). In a follow up study, Platz (1981) confirmed backcross levels using electrophoretic markers and noted a dramatic change in the ratio of *R. berlandieri* and *R. blairi*, favoring the former. Hillis (1981) made a comparative study of sympatric and allopatric populations of *R. berlandieri*, *R. blairi*, and *R. sphenocephala* and found staggered breeding seasons in sympatry, indicating the importance of temporal premating isolation. Hillis (1982) compared sympatric samples of *R. berlandieri* and *R. sphenocephala* tadpoles using multivariate morphometric analysis and found differences which would allow identification. Gambs and Littlejohn (1979) utilized playback experiments to determine the function of the chuckle call. Sage and Selander (1979) and Kocher and Sage (1986) used electrophoretic markers to characterize *R. berlandieri* and *R. sphenocephala* along a transect in central Texas. Frost (1982) reported cross results comparing *R. berlandieri* from New Mexico, Texas, and eastern México with *R. magnaocularis* and *R. berlandieri forreri* (= *R. forreri*) from western México, as well as *R. berlandieri brownorum* (= *R. brownorum*). Hillis et al. (1983) used the enzymatic products of 50 loci to provide a cladistic analysis of the *Rana pipiens* complex in the United States and México and assigned *R. berlandieri* to the beta subdivision. Platz et al. (1990) identified introduced specimens of *R. berlandieri* in Arizona and documented their recent range expansion along the lower Colorado and Gila rivers.

• **Remarks.** Pace (1974), Moore (1975), and Hillis (1988) each provided overviews of the *Rana pipiens* complex which are useful in

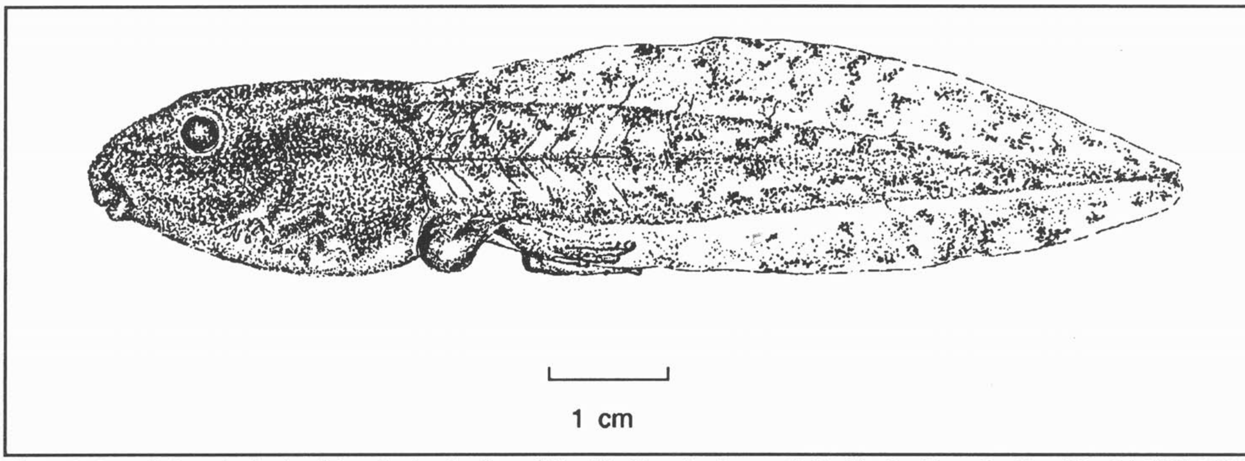


Figure 3. Lateral view of tadpole of *Rana berlandieri* from 6.3 km W of Junction (town of), Kimble Co., Texas, Rt. 83 and Co. Rd. 1674, AMNH 214137. Drawn by Amy Lathrop.

placing the status of *R. berlandieri* in perspective.

• **Etymology.** The name *berlandieri* honors Jean Louis Berlandier.

• **Comment.** According to Hillis (pers. comm.), male specimens from some extreme western Texas populations lack vestigial oviducts whereas other populations in this same area are polymorphic with respect to this trait. This anomaly also occurs in some populations in parts of México adjacent to western Texas. Hillis has found polymorphic electromorphs in the Texas populations to be in Hardy-Weinberg equilibrium, which he interprets as evidence for conspecific status.

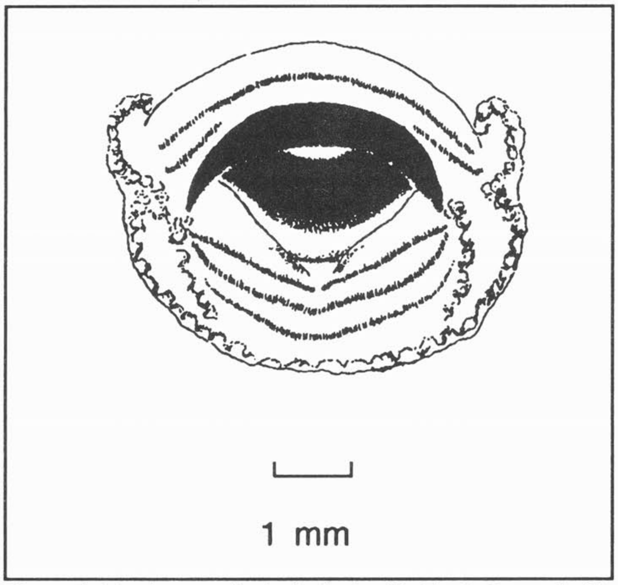


Figure 4. Mouth parts of tadpole depicted in Fig. 3. Camera lucida drawing by Amy Lathrop.

Literature Cited

Baird, S.F. 1859. Reptiles of the boundary, p. 1-35. *In* W.H. Emory, United States and Mexican boundary survey, Part II, Zoology of the boundary. Dept. Interior, Washington, D.C.

Cochran, D.M. 1961. Type specimens of reptiles and amphibians in the U.S. National Museum. Bull. U.S. Natl. Mus. 220:xv + 291 p.

Conant, R. 1975. A field guide to the reptiles and amphibians of eastern and central North America. 2nd ed. Houghton Mifflin Co., Boston.

—— and J.T. Collins. 1991. A field guide to the reptiles and amphibians, eastern and central North America. 3rd ed. Houghton Mifflin Co., Boston.

Cope, E.D. 1875. Check list of North American Batrachia and Reptilia; with a systematic list of the higher groups, and an essay on geographic distribution. Bull. U.S. Natl. Mus. 1:1-104.

——. 1886. Synonymic list of the North American species of *Bufo* and *Rana*, with descriptions of some new species of Batrachia in the National Museum. Amer. Phil. Soc. 23:514-526.

——. 1889. The Batrachia of North America. Bull. U.S. Natl. Mus. 34: 1-525.

Cuellar, H.S. 1971. Levels of genetic compatibility of *Rana areolata* with members of the *Rana pipiens* complex (Anura: Ranidae). Evolution 25:399-409.

Dixon, J.R. 1987. Amphibians and reptiles of Texas with keys, taxonomic synopses, bibliography, and distribution maps. Texas

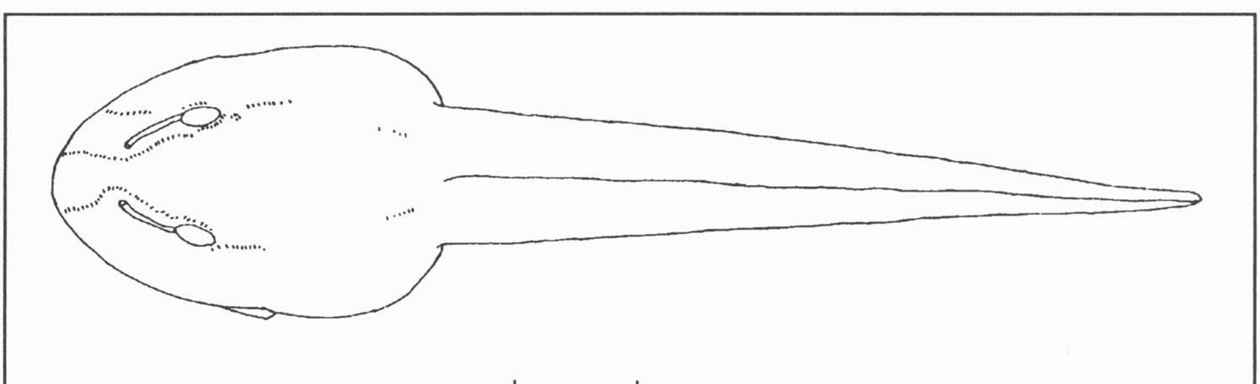


Figure 5. Lateral line system of tadpole depicted in Fig. 3. Camera lucida drawing by Amy Lathrop.

A&M Univ. Press, College Station.
Frost, J.S. 1982. Functional genetic similarity between geographically separated populations of mexican leopard frogs (*Rana pipiens* complex). Syst. Zool. 31:57-67.
Gambs, R.D. and M.J. Littlejohn. 1979. Acoustic behavior of males of the Rio Grande leopard frog (*Rana berlandieri*): an experimental analysis through field playback trials. Copeia 1979:643-650.
Hillis, D.M. 1981. Premating isolating mechanisms among three species of the *Rana pipiens* complex in Texas and southern Oklahoma. Copeia 1981:312-319.
——. 1982. Morphological differentiation and adaptation of the larvae of *Rana berlandieri* and *Rana sphenocephala* (*Rana pipiens* complex) in sympatry. Copeia 1982:168-174.
——. 1988. Systematics of the *Rana pipiens* complex: puzzle and paradigm. Ann. Rev. Ecol. Syst. 19:39-63.
——, J.S. Frost, and D.A. Wright. 1983. Phylogeny and biogeography of the *Rana pipiens* complex: a biochemical evaluation. Syst. Zool. 32:132-143.
Holman, J.A. 1969. The Pleistocene amphibians and reptiles of Texas. Publ. Michigan St. Mus. Biol. Ser. 4:163-192
Kocher, T.D. and R.D. Sage. 1986. Further genetic analyses of a hybrid zone between leopard frogs (*Rana pipiens* complex) in central Texas. Evolution 40:21-33.
Littlejohn, M.J. and R.S. Oldham. 1968. *Rana pipiens* complex: mating call structure and taxonomy. Science 162:1003-1005.
McAlister, W.H. 1962. Variation in *Rana pipiens* Schreber in Texas. Amer. Midl. Nat. 67:335-363.
Mecham, J.S. 1969. New information from experimental crosses on genetic relationships within the *Rana pipiens* species group. J. Exp. Zool. 170:169-180.
Mittleman, M.B. and H.T. Gier. 1942. Notes on leopard frogs. Proc. New England Zoöl. Club. 20:7-15.
Moore, J.A. 1975. *Rana pipiens* - the changing paradigm. Amer. Zool. 15:837-849.
Pace, A.E. 1974. Systematic and biological studies of the leopard frogs (*Rana pipiens* complex) of the United States. Univ. Michigan Mus. Zool. Misc. Publ. (148):1-140.
Platz, J.E. 1972. Sympatric interaction between two forms of leopard frog (*Rana pipiens* complex) in Texas. Copeia 1972:232-40.
——. 1981. Suture zone dynamics: Texas populations of *Rana berlandieri* and *R. blairi*. Copeia 1981:733-734.
——, R.B. Clarkson, J.C. Rorabaugh, and D.M. Hillis. 1990. *Rana berlandieri*: recently introduced populations in Arizona and southwestern California. Copeia 1990:324-333.
Purcell, J.W. 1968. Embryonic temperature adaptations in southwestern populations of *Rana pipiens*. M.S. thesis. Texas Tech Univ., Lubbock.
Sage, R.D. and R.K. Selander. 1979. Hybridization between species of the *Rana pipiens* complex in central Texas. Evolution 33:1069-1088.
Salthe, S.N. 1969. Geographic variation of the lactate dehydrogenases of *Rana pipiens* and *Rana palustris*. Biochem. Genet. 2:271-303.
Sanders, O. 1973. A new leopard frog (*Rana berlandieri brownorum*) from southern Mexico. J. Herpetol. 7:87-92.
Scott, N.J., Jr. and R.D. Jennings. 1985. The tadpoles of five species of New Mexican leopard frogs. Occ. Pap. Mus. Southwest. Biol. (3):1-21.
Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. 2nd ed. Houghton Mifflin Co., Boston.
Wright, A.H. and A.A. Wright. 1949. Handbook of frogs and toads. 3rd ed. Comstock. Ithaca, NY.

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